Aspidiotus circularis Fitch, 3d Rep. Nox. Ins. N. Y., p. 426 (1856), can never be specifically determined, because the single remaining type specimen is immature and in poor condition. It appears to be either *Aspidiotus ancylus* Putn. or *A. forbesi* Johns.

Mr. Schwarz related the history of the Fitch collection and note-books and the method in which part of them had been purchased by the Department of Agriculture from a dealer in second-hand books and insects in Philadelphia.

The second paper was by Mr. Knab, as follows.

THE FEEDING-HABITS OF GERANOMYIA.

[Diptera, Tipulidæ.]

By Frederick Knab.

Among the Tipulidæ there are a number of genera which possess a greatly elongated proboscis. This peculiarity indicates specialization in feeding-habit and a natural suggestion is that these insects feed upon the nectar of flowers or upon vegetable juices. Definite information upon this subject is, however, very scant. It would seem that, with the exception of *Geranomyia*, nothing has been made known concerning the feeding-habits of these genera, and even with this genus, so common in North America, information is meager and unsatisfactory.

Say, in his original description of *Geranomyia rostrata*, states that this insect occurs "on flowers."*

Osten-Sacken makes the statement that in *Geranomyia* the proboscis is "used for sucking moisture and flowers."†

The only definite records I have found are by Robertson and by Graenicher. Robertson has recorded *Geranomyia canadensis* as sucking the flowers of *Cacalia reniformis* Mulh., a composite ‡ Graenicher has recently reported the same species as a flower-visitor of the composites *Solidago juncea* Ait. and *Rudbeckia hirta* L.§ These records are unsatisfactory, at least from the entomologist's standpoint, in that they do not indicate that more than a stray specimen was seen, nor supply further data, such as the sex of the specimen or the

*Journ. Acad. Nat. Sci. Phila., III, (1823), p. 23.
†Smiths. Misc. Coll., No. 219 (1869), p. 78.
‡Trans. Acad. Sci. St. Louis, VII (1896), p. 179.
§Bull. Wisc. Nat. Hist. Soc., VII (1909), pp. 56, 64.

time of day. In view of this paucity of information I was much pleased when opportunity came to observe these neglected insects.

An entomological excursion, on September 19, 1908, led me up the Potomac to Cabin John, Maryland. Rather late in the afternoon, emerging from the woods to the banks of the old Chesapeake and Ohio Canal, I came upon a luxurious growth of *Verbesina alternifolia* (L.) Britt., a yellow-flowered composite, then in full bloom. Frightened by my sudden approach, two small Tipulidæ rose from the flower-heads and hovered in the air above them, evidently reluctant to leave. They soon returned to their respective flower-heads and, after executing for a time a curious, very rapid, vibrating movement by swinging upon their long, slender legs, they probed eagerly into the florets. They were captured without difficulty and proved to be a male and female of *Geranomyia canadensis* Westwood.

The past season I visited the same patch of *Verbesina* again, on September 18, and was gratified to find *Geranomyia* present in considerable numbers. It was about 4.30 in the afternoon and the sun was already low. At first there were but a few individuals present upon the flowers, very busily probing for honey. As the sunlight faded their number increased, so that soon there were several upon every plant, sometimes two or three on one flower-head. They would first hover nervously over the flower for a brief period, then descend upon the flower and for a short interval go through the curious vibrating movement, and finally begin work upon the flowers in the most eager manner. They would walk about upon the flower-heads and plunge the proboscis deep into a floret and, after a brief interval, withdraw it and insert it in another; repeating this many times, each time with a new floret. I watched the insects for a full hour and saw hundreds of them within a radius of ten or fifteen feet. The precision with which they sought the nectar showed very clearly that the habit was well fixed. All belonged to one species, *Geranomyia canadensis*, and both sexes were represented in about equal numbers.

It was now evening and growing cool and I turned homeward. In passing through a glade beside a stream I found a number of *Geranomyia* upon the flower-head of an *Eupatorium purpureum* L., growing at the edge of the thicket. Here two species of *Geranomyia* were present; in addition to the species already observed, and outnumbering it, was *G. rostrata* Say.

A little farther on I found both species again upon *Solidago canadensis* L., and *Geranomyia rostrata*, which all through the glade outnumbered the other species, also upon *Solidago rugosa* Müll.

A week later, in an excursion to Lakeland, Maryland, I observed *Geranomyia* again; this time only *G. rostrata*. They did not appear until near sunset, and this later appearance here I attribute to the open character of the region. They were again upon the flowers of *Eupatorium purpureum* and in addition they visited the flowers of *Helianthus strumosus* L. Still a week later, on October 3, I found an individual of *Geranomyia canadensis* upon a flower of *Aster cordifolius* L. in Rock Creek Park (Washington).

Two further records are due to the kindness of Mr. W. L. McAtee. He observed *Geranomyia canadensis* on the flowers of *Eupatorium ageratoides* L. at Plummers Island, Maryland, September 12, 1909. *Geranomyia diversa* O. S., apparently a rare species, was taken by him at Beltsville, Maryland, August 4, 1909, upon the flowers of *Solidago canadensis* L.

It is worth noting that all these visits of *Geranomyia*, those recorded by others as well as those observed by myself, were to flowers of Compositæ. The flowers of this group of plants are well understood to be so organized that they are profitable only to insects which are specialized to reach the nectar at the bottom of the deep and narrow tube, this latter protecting the honey from undesirable marauders and rain. When we consider, then, the character of the flowers visited by *Geranomyia*, its proboscis appears clearly as an adaption to flowers, moreover to those flowers which offer a superior quality of honey to those insects organized to obtain it. It is rather surprising, with these facts before us, to find that Graenicher, in his study of the flower-visitors of Compositæ, classes *Geranomyia* among the "allotropous" visitors; that is, those which are occasional, show little or no adaption to the flower, and are unimportant to the plant. As to this last I cannot answer, but certainly *Geranomyia*, with its long proboscis, is specialized to probe into flowers with deep and narrow honey-tubes. Quite likely the close relation of *Geranomyia* to flowers has escaped notice on account of its crepuscular habits. It was only after I became aware of this that I was able to make more conclusive observations.

A number of Tipulidæ of other genera have been recorded as flower-visitors by students of the fertilization of flowers by insects. Knuth, who has brought together the records of in-

sect visitors of flowers in his "Blüthenbiologie," lists a number of flower-visiting Tipulidæ, mostly observed in Europe. With the exception of a single *Ptychoptera*, the species all belong to *Tipula* and *Pachyrrhina*. It seems doubtful, however, if all of these species should be considered flower-visitors. In a few cases, as in most of Hermann Müller's records, it is distinctly stated that the insects were sucking or lapping honey; in others there is nothing to indicate that the presence of the insect on the flower was more than accidental. The fact that a large number of the European records are from Umbelliferæ is significant; in these flowers the honey is exposed and easily accessible, thus requiring no specialization of the insect visitor's mouthparts. It does not seem worth while to give all the European records here.

Apparently but two species of Tipulidæ, other than *Geranomyia*, have been recorded as flower-visitors in North America. Both of these were observed by Dr. Graenicher in Wisconsin.* He records *Tipula graphica* Doane† as a visitor of the "carrion flower," *Smilax ecirrhata* S. Wats. (Smilaceæ), and *Pachyrrhina pedunculata* Loew on flowers of *Evonymus atropurpurens* Jacq. (Celastraceæ).

Two species of Tipulidæ, described by Karsch from West Africa,‡ have found their way into the records of flower-visitors. They are *Dicranomyia tipulipes* and *Pachyrrhina fuscipenni*, both said to occur upon the composite *Vernonia senegalensis*. It seems quite certain that these should be eliminated. They were components of a collection of Diptera captured *mostly* upon the flowers of *Vernonia*. There were no notes from the collector to show which of the species he collected actually came from the flowers. It is more than probable that the honey of the flowers of *Vernonia* would be inaccessible to Tipulidæ without specially modified mouthparts. These records, indeed, are the only ones, outside of *Geranomyia* with its elongated proboscis, of Tipulidæ visiting Compositæ.

These few observations show how little we know of the habits of the Tipulidæ; aside from the flower-visits I do not recall a single mention of the feeding-habits of this extensive group of Diptera. Probably the difficulty of preserving them

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*Bull. Wisc. Nat. Hist. Soc., II (1892), pp. 31, 36.

†This determination seems open to doubt, as the species was described from California and its occurrence in Wisconsin would indicate an unusual distribution.

‡Entom. Nachrichten, XII (1886), pp. 51–53.

satisfactorily, and, in the case of our American species, also the difficulty of identification, have caused these insects to be much neglected.

I am under obligation to Mr. E. S. Steele, of the U. S. National Museum, for kindly determining for me the plants in my observations.

Since the above was written Mr. S. A. Rohwer has placed at my disposal his notes on two flower-visiting species of Tipulidæ, observed by him at Florissant, Colorado, The species were determined by Mr. Coquillett as *Erioptera caloptera* Say and *Helobia hybrida* Meigen (the latter is placed as a synonym of *H. punctipennis* Meigen in the Aldrich Catalogue). Both species were found on the flower-heads of the common cow parsnip, *Heracleum lanatum* Michx., July 2–4, in the heat of the day. Only a few of the *Helobia* were found, but the *Erioptera* was very abundant and he swept many of them off the flowers with his net in capturing Hymenoptera. They were present on the flowers only during the heat of the day and in the evening they were found on leaves or resting upon the sides of buildings. In view of what has been said above regarding the preponderance of Umbelliferæ in the European records, the occurrence of two of our species, one of them in abundance, on a plant of this family, is significant.

Dr. Howard stated that specimens of *Geranomyia* were frequently sent in by correspondents under the supposition that they were mosquitoes, and asked if there was anything in their habits that caused the error.

Mr. Knab stated that during the day they remained in dark situations, such as cellars or outhouses, resting on the walls, just as *Anopheles* and others mosquitoes do.

Mr. Knab pointed out that the habits of *Geranomyia* throw an interesting side-light on the origin of the blood-sucking habit in mosquitoes. While the probosces of mosquitoes and of *Geranomyia* were developed independently and differ in structure, they could nevertheless both be considered adaptations to similar habits. In other words, mosquitoes were originally feeders upon the juices of plants, such as the nectar of flowers, and in fact many species are exclusively so at present. The males, which as a whole have continued plant-feeders, represent, then, a more primitive state in this respect, and